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EXAMINER	
NOLAN, PETER D	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/546,625	HECKER ET AL.
	Examiner	**Art Unit**
	Peter D. Nolan	3661

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 13 March 2009.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 13-30 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 13-30 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

The amendment to the claims filed 3/13/2009 has been entered. New claims 27-30 have been entered. Claims 13-30 remain pending.

The objection to claim 26 has been withdrawn in light of the amendment.

Response to Arguments

1. Applicant's arguments filed 3/13/2009 have been fully considered but they are not persuasive.

2. Applicant asserts that Hayakawa fails to disclose the feature of *an assumption of a constant gradient angle* when estimating the vehicle mass. Applicant references page 3, lines 15-31 of his submitted specification in explaining that *when a vehicle is traveling along any route, gradient angle α of the roadway is a function of time t and if one assumes the change in gradient angle α(t) is very small in time interval dt considered, the influence of gradient angle α(t) may be assumed to be constant for a time, so that gradient angle α may not have to be estimated, calculated or measured by a cost-creating sensor*.

3. Examiner respectfully disagrees with Applicant's reading of Hayakawa. Further reading of Hayakawa shows that the gradient angle change is assumed to be very small during a time interval, therefore the influence of the gradient may be assumed to be constant for a time (**see Hayakawa column 5, lines 36-45 where it is taught that laws require the gradient on a roadway to vary no more than a maximum amount and it may be assumed that the gradient variation is small. See also figure 3 and column 5, line 46 thru column 6, line 12 where the frequency analysis of the**

gradient as a function of time, Θ(t), shows that even when a vehicle runs on a road with a varying gradient at a speed twice as high as the design speed, the Θ(t) only contains frequency components equal to or less than 1 Hz. Frequency components related to a change in gradient are those of merely 2 Hz whereas the variation of the driving force contains large frequency components of 2 Hz or higher). It should be noted that an assumption of a small gradient variation is identical to Applicant's assumption of a constant gradient (**see Applicant's specification page 3, lines 21-30 where the assumption of a constant gradient is actually an assumption of a small change in the gradient interval in the time interval dt considered**).

4. Applicant further asserts that equation (4) in Hayakawa column 5 is not an equilibrium relationship between a motive force and a sum of inertial force and drive resistances in which the mass and a gradient angle of a roadway are included as quantities, assuming a constant gradient angle because of the presence in expression (4) of $\underline{\Theta}$, denoting the gradient deducted by a signal of a predetermined or lower frequency.

5. However Hayakawa teaches solving expression (4) with an assumption of a constant gradient angle (**see Hayakawa column 6, lines 18-23 where expression (4) may be solved with a cut-off frequency of 2 Hz. As explained above, this cutoff frequency is based on the assumption that the variations in the gradient are small and an assumption of a small gradient variation is equivalent to the assumption of a constant gradient as detailed in Applicant's specification**). If a cutoff

frequency greater than the frequency of the gradient variations is selected, such as 2 Hz, Θ is eliminated or minimized.

6. Applicant further asserts that equation (5) in Hayakawa is not equivalent to the equation claimed in claim 16 because equation (5) contains the residual error e(k) and therefore the road gradient is not assumed to be constant when solving equation (5) for the mass of the vehicle.

7. Examiner respectfully disagrees with Applicant's interpretation of equation (5). As explained in Hayakawa, equation (5) is another expression of equation (4) where the effect of the gradient is expressed as a residual error e(k). The mass may be determined instantly by neglecting e(k) (**see Hayakawa column 6, lines 26-41**) in which case equation (5) is equivalent to the equation in claim 16. While Hayakawa also teaches not neglecting e(k) when it is not negligible, it should be noted that e(k) is neither calculated nor measured in Hayakawa and is a residual error. The vehicle mass is still calculated using only the equilibrium between the filtered acceleration and force as shown in equation (5) and the residual error is removed through a least squares method (**see Hayakawa column 6, lines 35-41**). It should be noted that Applicant also envisions a residual error present in the equilibrium relationship that is to be removed through a least squares method (**see Applicant's specification page 5, lines 20-26 and claim 21**).

8. Applicant further asserts that the cited prior art fails to teach the calculation of the reciprocal value of the mass as claimed in claim 23. Applicant argues that: (1) it would not be obvious to combine Mori with Hayakawa because Hayakawa refers to a vehicle

mass calculation device that calculates mass based on other variables whereas Mori teaches use of mass as a variable in determining a vehicle dynamic, and (2) it would be not be obvious to combine Randal and Predko because the present application is directed towards estimating the mass of a vehicle and reducing the computational load is not an obvious choice for improving the efficiency of methods for estimating the mass of the vehicle.

9. Examiner respectfully disagrees with Applicant's arguments regarding the rejection of claim 23. Applicant is correct that Hayakawa teaches a device for estimating the vehicle mass and the other references are not directed to the estimation of the vehicle mass. However, this fails to address the reasons for obviousness put forth in the Office Action in which the combination of references suggest estimating the mass and it's reciprocal for the purposes of improving the overall operational efficiency of a vehicle computing system. As admitted by Applicant on page 1, lines 6-14, mass estimates are used in electronic vehicle systems. Mori teaches an electronic vehicle system that uses mass in its calculation (**see Mori figure 1 and figure 4, equation 6. See also column 7, lines 20-27**) and is therefore analogous prior art. In addition, it would be obvious to a vehicle control system designer to reduce computational load and one way to do so would be to use the method taught in Randall and Predko to provide the mass and the reciprocal of the mass to a vehicle control system, such as the one in Mori. In this regard, the fact that the secondary references are not directed towards mass estimation or the reason for mass estimation given in Applicant's specification is irrelevant.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 13-17, 21, 22, 24, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayakawa et al. (US 6347269 B1) in view of Crapanzano et al. (US 4773013).

3. **Regarding claim 13**, Hayakawa teaches a method for effecting a computer-aided estimation of a mass of a vehicle, comprising: high pass filtering an equilibrium relationship, between a motive force and a sum of an inertial force and drive resistances, in which the mass and a gradient angle of a roadway are included as quantities, with respect to time, assuming a constant gradient angle; and calculating at least one of (a) the mass of the vehicle and (b) a reciprocal value of the mass of the vehicle from the equilibrium relationship passed through a high pass filter (**see Hayakawa Abstract; column 4, lines 42-49; column 5, lines 5-15; column 5, lines 36-45; figure 3 and column 5, line 46 thru column 6, line 23**).

4. However, while Hayakawa teaches where the equilibrium relationship is passed through a high pass filter, it does not explicitly teach where the equilibrium relationship is computer differentiated with respect to time.

5. Crapanzano teaches an antiskid control system for a vehicle that uses a high pass filter to determine the derivative of the deceleration of the vehicle (**see**

Crapanzano column 6, lines 62-68 and column 7, lines 1-5 where the wheel speed of an aircraft is passed through a first differentiator to determine the deceleration of an aircraft, i.e. the first derivative of the wheel speed, which is then passed through a second differentiator to determine the rate of change of deceleration, i.e. the second derivative of the wheel speed. Both differentiators are high pass filters. Although Crapanzano teaches where only the derivative of the deceleration is determined, the high pass filtering is equally applicable to determine the derivative of the acceleration or the force).

6. It would be obvious to one skilled in the art to use the high pass filter as taught in Hayakawa to differentiate the equilibrium relationship with respect to time because a high pass filter may be used to determine the derivative of a value and determining the derivative of a value is well known in the art as taught in Crapanzano (**see Crapanzano column 6, lines 62-68 and column 7, lines 1-5**).

7. **Regarding claim 14**, Hayakawa, as modified by Crapanzano in claim 13, teaches where the vehicle includes a commercial vehicle (**see Hayakawa column 1, lines 18-33**).

8. **Regarding claim 15**, Hayakawa, as modified by Crapanzano in claim 13, teaches where the drive resistances include a sum of one of (a) an accelerative force and (b) a deceleration force as a function of the mass and one of (a) an uphill force and (b) a downhill force as a function of the gradient angle (**see the rejection of claim 13 above. See also Hayakawa column 7, lines 38-51 and column 4, lines 31-41**).

9. **Regarding claim 16**, Hayakawa, as modified by Crapanzano in claim 13, teaches where the mass is calculated from the equation: $m = (dF / dt) / (da / dt)$ wherein *a* represents a time derivation of a longitudinal vehicle velocity and *F* represents the motive force of the vehicle (**see Hayakawa column 6, lines 26-41 where the mass can be determined from equation (5) "$\underline{\alpha}(k) = \underline{F}(k)/(\theta m) + e(k)$" where $\underline{\alpha}$ is the acceleration deducted by a signal of lower frequency, $\underline{F}$ is the driving force deducted by a lower frequency, k is a sampling time interval, θm is the vehicle mass, and e is the residual error due to the gradient. In instances where e(k) is negligible, it can be ignored and rearranging equation 5 will result in $\theta m = \underline{F}(k)/\underline{\alpha}(k)$. See the rejection of claim 13 above regarding determining the derivative using a high pass filter**).

10. **Regarding claim 17**, Hayakawa, as modified by Crapanzano in claim 13, teaches where the method further comprises: determining, from measured quantities, the motive force and the one of (a) the acceleration and (b) the deceleration (**see Hayakawa figure 6, acceleration sensor 30, throttle valve sensor 12, engine rotation speed sensor 14, shift sensor 18, vehicle speed sensor 20. See also column 7, lines 18-58**).

11. **Regarding claim 21**, Hayakawa, as modified by Crapanzano in claim 13, teaches where the computer-aided differentiating is performed continuously and recursively (**see Hayakawa column 6, lines 26-60**).

12. **Regarding claim 22**, Hayakawa, as modified by Crapanzano in claim 13, teaches where the computer-aided differentiating is performed one of (a) according to a

two-point differentiation and (b) with a state-variable filter (**see the rejection of claim 13 regarding differentiation**).

13. **Regarding claim 24**, Hayakawa teaches a device for effecting a computer-aided estimation of a mass of a vehicle, comprising: a calculation unit adapted to calculate at least one of (a) the mass of the vehicle and (b) a reciprocal value of the mass of the vehicle from an equilibrium relationship between a motive force and a sum of an inertial force and drive resistances, the mass and a gradient angle of a roadway included as calculation quantities, after a computer-aided differentiation of the equilibrium relationship with respect to time, assuming a constant gradient angle (**see Hayakawa Abstract; column 4, lines 42-49; column 5, lines 5-15; column 5, lines 36-45; figure 3 and column 5, line 46 thru column 6, line 12**).

14. However, while Hayakawa teaches where the equilibrium relationship is passed through a high pass filter, it does not explicitly teach where the equilibrium relationship is computer differentiated with respect to time.

15. Crapanzano teaches an antiskid control system for a vehicle that uses a high pass filter to determine the derivative of the deceleration of the vehicle (**see Crapanzano column 6, lines 62-68 and column 7, lines 1-5 where the wheel speed of an aircraft is passed through a first differentiator to determine the deceleration of an aircraft, i.e. the first derivative of the wheel speed, which is then passed through a second differentiator to determine the rate of change of deceleration, i.e. the second derivative of the wheel speed. Both differentiators are high pass filters. Although Crapanzano teaches where only the derivative of the**

deceleration is determined, the high pass filtering is equally applicable to determine the derivative of the acceleration or the force).

16. It would be obvious to one skilled in the art to use the high pass filter as taught in Hayakawa to differentiate the equilibrium relationship with respect to time because a high pass filter may be used to determine the derivative of a value and determining the derivative of a value is well known in the art as taught in Crapanzano (**see Crapanzano column 6, lines 62-68 and column 7, lines 1-5**).

17. **Regarding claim 25**, Hayakawa, as modified by Crapanzano in claim 24, teaches where the vehicle includes a commercial vehicle (**see Hayakawa column 1, lines 18-33**).

18. Claims 18-20, 26, 27, 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayakawa et al. (US 6347269 B1) in view of Crapanzano et al. (US 4773013) and further in view of Zhu et al. (US 6167357).

19. **Regarding claim 18**, Hayakawa, as modified by Crapanzano in claim 13, does not explicitly teach where the measured quantities are available in a control unit of the vehicle.

20. Zhu teaches where the measured quantities are available in a control unit of the vehicle (**see Zhu figure 1, control system 10, vehicle speed sensor 24, accelerometer 46, accelerator pedal 26, fuel system 30 and control computer 12. See also column 8, lines 21-33**).

21. It would be obvious to one skilled in the art for the measured quantities taught in Hayakawa to be available in a control unit of the vehicle as taught in Zhu because an

engine control system typically includes sensors and logic for determining driving force and acceleration.

22. **Regarding claim 19**, Hayakawa, as modified by Crapanzano in claim 13 and further modified by Zhu in claim 18, does not teach where the method further comprises filtering the measured quantities as a function of a signal quality.

23. Zhu further teaches where the measured quantities of acceleration and drive force are filtered as a function of signal quality (**see Zhu figure 2, stage 110. See also Zhu column 10, lines 65-67 and column 11, lines 1-17**).

24. It would be obvious to one skilled in the art to add the step of filtering the measured values of acceleration and drive force as taught in Zhu to the method of calculating vehicle mass taught in Hayakawa because filtering measured quantities as a function of the signal quality ensures that the data is capable of being reliably used to estimate vehicle mass (**see Zhu column 11, lines 11-17**).

25. **Regarding claim 20**, Hayakawa, as modified by Crapanzano in claim 13, does not teach where the method further comprises: repeatedly measuring the measured quantities; and weighting the measurements differently.

26. Zhu teaches where a method for estimating vehicle weight includes a step for repeatedly measuring the measured quantities and weighing the measurements differently (**see Zhu method 100 showing repeated measurement of the data points in step 104. See also Zhu column 10, lines 46 through 67; column 11, lines 1-17; column 11, lines 18-38**).

27. It would be obvious to one skilled in the art to add the step of repeatedly measuring the acceleration and drive force and weighing the measurements differently as taught in Zhu to the method of calculating vehicle mass taught in Hayakawa because this ensures that the data is capable of being reliably used to estimate vehicle mass (**see Zhu column 11, lines 11-17**).

28. **Regarding claim 26**, Hayakawa, as modified by Crapanzano in claim 24, does not explicitly teach the calculation unit is integrated into a control unit of the vehicle.

29. Zhu teaches where a mass calculation unit is integrated into a control unit of a vehicle (**see Zhu figure 1, control system 10, vehicle speed sensor 24, accelerometer 46, accelerator pedal 26, fuel system 30 and control computer 12. See also column 8, lines 21-33 and column 3, lines 58-62**).

30. It would be obvious to one skilled in the art to integrate the vehicle mass calculation unit in Hayakawa into a control unit of a vehicle as taught in Zhu because an engine control system typically includes sensors and logic for determining driving force and acceleration. A mass calculation unit that is separate from the control unit would add cost and complexity to the vehicle with no added utility.

31. **Regarding claim 27**, Hayakawa, as modified by Crapanzano in claim 24, teaches where, from measured quantities, the motive force and the one of (a) the acceleration and (b) the deceleration are determined (**see Hayakawa figure 6, acceleration sensor 30, throttle valve sensor 12, engine rotation speed sensor 14, shift sensor 18, vehicle speed sensor 20. See also Hayakawa column 7, lines 18-58**), the measured quantities are repeatedly measured (**see Hayakawa column 7, lines**

48-54), the drive resistances include a sum of one of (a) an accelerative force and (b) a deceleration force as a function of the mass and one of (a) an uphill force and (b) a downhill force as a function of the gradient angle (**see Hayakawa column 7, lines 38-51 and column 4, lines 31-41**), wherein the mass is calculated from the equation of $m = (dF / dt) / (da / dt)$ wherein a represents a time derivation of a longitudinal vehicle velocity and F represents the motive force of the vehicle (**see Hayakawa column 6, lines 26-41 where the mass can be determined from equation (5) "$\underline{\alpha}(k) = \underline{F}(k)/(\theta m) + e(k)$" where $\underline{\alpha}$ is the acceleration deducted by a signal of lower frequency, $\underline{F}$ is the driving force deducted by a lower frequency, k is a sampling time interval, θm is the vehicle mass, and e is the residual error due to the gradient. In instances where e(k) is negligible, it can be ignored and rearranging equation 5 will result in $\theta m = \underline{F}(k)/ \underline{\alpha}(k)$. See the rejection of claim 24 above regarding determining the derivative using a high pass filter**).

32. However, Hayakawa, as modified by Crapanzano in claim 24 does not teach where the measured quantities are repeatedly measured <u>and</u> the measurements are weighted differently; the measured quantities are filtered as a function of a signal quality; and where the measured quantities are available in a control unit of the vehicle.

33. Zhu teaches where a method for estimating vehicle weight includes a step for repeatedly measuring the measured quantities and weighing the measurements differently (**see Zhu method 100 showing repeated measurement of the data points in step 104. See also Zhu column 10, lines 46 through 67; column 11, lines 1-17; column 11, lines 18-38**); filtering the measured quantities as a function of a signal

quality (**see Zhu figure 2, stage 110. See also Zhu column 10, lines 65-67 and column 11, lines 1-17**); and where the measured quantities are available in a control unit of the vehicle (**see Zhu figure 1, control system 10, vehicle speed sensor 24, accelerometer 46, accelerator pedal 26, fuel system 30 and control computer 12. See also column 8, lines 21-33**).

34. It would be obvious to one skilled in the art to add the step of repeatedly measuring the acceleration and drive force and weighing the measurements differently as taught in Zhu to the method implemented by the device for calculating vehicle mass taught in Hayakawa because this ensures that the data is capable of being reliably used to estimate vehicle mass (**see Zhu column 11, lines 11-17**). It would further be obvious to one skilled in the art to add the step of filtering the measured values of acceleration and drive force as taught in Zhu because filtering measured quantities as a function of the signal quality ensures that the data is capable of being reliably used to estimate the vehicle mass (**see Zhu column 11, lines 11-17**). It would further still be obvious to one skilled in the art for the measured quantities taught by Hayakawa to be available in a control unit of the vehicle as taught in Zhu because an engine control system typically includes sensors and logic for determining driving force and acceleration.

35. **Regarding claim 29**, Hayakawa, as modified by Crapanzano in claim 13, teaches where the method further comprises: determining, from measured quantities, the motive force and the one of (a) the acceleration and (b) the deceleration (**see Hayakawa figure 6, acceleration sensor 30, throttle valve sensor 12, engine rotation speed sensor 14, shift sensor 18, vehicle speed sensor 20. See also**

Hayakawa column 7, lines 18-58); repeatedly measuring the measured quantities (**see Hayakawa column 7, lines 48-54**) wherein the drive resistances include a sum of one of (a) an accelerative force and (b) a deceleration force as a function of the mass and one of (a) an uphill force and (b) a downhill force as a function of the gradient angle (**see Hayakawa column 7, lines 44-51 and column 4, lines 31-41**), wherein the mass is calculated from the equation of $m = (dF / dt) / (da / dt)$ wherein *a* represents a time derivation of a longitudinal vehicle velocity and *F* represents the motive force of the vehicle (**see Hayakawa column 6, lines 26-41 where the mass can be determined from equation (5) "$\underline{\alpha}(k) = \underline{F}(k)/(\theta m) + e(k)$" where $\underline{\alpha}$ is the acceleration deducted by a signal of lower frequency, $\underline{F}$ is the driving force deducted by a lower frequency, k is a sampling time interval, θm is the vehicle mass, and e is the residual error due to the gradient. In instances where e(k) is negligible, it can be ignored and rearranging equation 5 will result in $\theta m = \underline{F}(k)/ \underline{\alpha}(k)$. See the rejection of claim 13 above regarding determining the derivative using a high pass filter**).

36. However, Hayakawa, as modified by Crapanzano in claim 13, does not teach Repeatedly measuring the measured quantities <u>and</u> weighting the measurements differently; filtering the measured quantities as a function of a signal quality; and wherein the measured quantities are available in a control unit of the vehicle.

37. Zhu teaches where a method for estimating vehicle weight includes a step for repeatedly measuring the measured quantities and weighing the measurements differently (**see Zhu method 100 showing repeated measurement of the data points in step 104. See also Zhu column 10, lines 46 through 67; column 11, lines 1-17;**

column 11, lines 18-38); filtering the measured quantities as a function of a signal quality (**see Zhu figure 2, stage 110. See also Zhu column 10, lines 65-67 and column 11, lines 1-17**); and where the measured quantities are available in a control unit of the vehicle (**see Zhu figure 1, control system 10, vehicle speed sensor 24, accelerometer 46, accelerator pedal 26, fuel system 30 and control computer 12. See also column 8, lines 21-33**).

38. It would be obvious to one skilled in the art to add the step of repeatedly measuring the acceleration and drive force and weighing the measurements differently as taught in Zhu to the method of calculating vehicle mass taught in Hayakawa because this ensures that the data is capable of being reliably used to estimate vehicle mass (**see Zhu column 11, lines 11-17**). It would further be obvious to one skilled in the art to add the step of filtering the measured values of acceleration and drive force as taught in Zhu because filtering measured quantities as a function of the signal quality ensures that the data is capable of being reliably used to estimate the vehicle mass (**see Zhu column 11, lines 11-17**). It would further still be obvious to one skilled in the art for the measured quantities taught by Hayakawa to be available in a control unit of the vehicle as taught in Zhu because an engine control system typically includes sensors and logic for determining driving force and acceleration.

39. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayakawa et al. (US 6347269 B1) in view of Crapanzano et al. (US 4773013) and further in view of Mori (US 6745112 B2), Randal et. al (V. T. Randal, J. L. Schmalzel, and A. P. Shepard, “Floating-Point Computation Using a Microcontroller,” Proceedings

of the Annual International Conference of the IEEE, 1988, pp 1243-1244, vol. 3), Predko (M. Predko, *Programming and Customizing the PIC Microcontroller*. New York, NY: McGraw-Hill, 1998), and Bellinger et al. (US 6567734 B2).

40. **Regarding claim 23**, Hayakawa, as modified by Crapanzano in claim 13, does not teach where the method further comprises calculating the mass.

41. However, Hayakawa does not teach where the method further comprises calculating the reciprocal of the mass or forming a weighted average value.

42. Mori teaches where mass is used in the calculation of vehicle parameters, specifically where mass is used as a divisor (**see Mori figures 4 and 9A where a vehicle a vehicle side slip angle is estimated in part by calculating a vehicle side slip angle differential using equation 6 which uses mass as a divisor**).

43. Randal and Predko teach where using a reciprocal of a value as a multiplier can be more efficient than using the value itself as a divisor (**see Randal page 2, column 1 where an 8051 microprocessor running floating point routines required 450 cycles to run a typical multiplication operation and 1070 cycles to run a typical division operation. See also Predko pages 302-304 for pseudo-code representing multiplication and division in a microcontroller where multiplication requires fewer steps than division. It is well known in the art that division in a microprocessor typically requires more computational resources than multiplication. Therefore, in situations where a value is repeatedly used as a divisor, it is more efficient to determine the reciprocal and use it as a multiplier**).

44. It would be obvious to one skilled in the art to calculate the reciprocal value of the mass in Hayakawa because reducing computational load when determining a vehicle dynamic which require mass as a variable, such as the side slip angle, is desirable (**see Mori column 1, lines 59-64 where conventional side slip angle estimation methods are problematic due to the increase in the computational load**) and calculating the inverse of the mass and using it as a multiplier in algorithms which call for it to be used repeatedly as a divisor would reduce the computational load (**see Mori figure 4, equation 6. Solving equation 6 using mass would require three division operations whereas solving equation 6 using the reciprocal of mass would require one division operation to find the reciprocal of the mass and 3 multiplication operations. The latter method would be more efficient, as shown by Randal and Predko**).

45. Bellinger teaches a method for estimating a vehicle mass where the method further comprises forming a weighted average value (**see Bellinger column 22, lines 49-67 and column 23, lines 1-26 where a vehicle mass estimate is computed as a weighted average of the samples contained in a register holding a predefined number of instantaneous vehicle mass samples**).

46. It would be obvious to one skilled in the art to add a step forming a weighted average value of the estimated mass as taught in Bellinger to the method of determining vehicle mass taught in Hayakawa because weighted averaging is well known in the art (**see Bellinger column 22, lines 21-25 where it is explained that those skilled in the art will recognize other known techniques for computing the estimated vehicle**

mass as an average, weighted or otherwise, of at least some of the instantaneous vehicle mass samples).

47. Claims 28, 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayakawa et al. (US 6347269 B1) in view of Crapanzano et al. (US 4773013) and further in view of Mori (US 6745112 B2), Randal et. al (V. T. Randal, J. L. Schmalzel, and A. P. Shepard, "Floating-Point Computation Using a Microcontroller," Proceedings of the Annual International Conference of the IEEE, 1988, pp 1243-1244, vol. 3) and Predko (M. Predko, *Programming and Customizing the PIC Microcontroller*. New York, NY: McGraw-Hill, 1998).

48. **Regarding claim 28**, Hayakawa, as modified by Crapanzano in claim 24, teaches where the computer-aided differentiating is performed continuously and recursively (**see Hayakawa column 6, lines 26-60**), wherein the computer-aided differentiating is performed one of (a) according to a two-point differentiation and (b) with a state-variable filter (**see the rejection of claim 24 above regarding differentiation**)

49. However, Hayakawa, as modified by Crapanzano in claim 24 does not teach wherein the calculating includes calculating the mass and a reciprocal value of the mass.

50. Mori teaches where mass is used in the calculation of vehicle parameters, specifically where mass is used as a divisor (**see Mori figures 4 and 9A where a vehicle a vehicle side slip angle is estimated in part by calculating a vehicle side slip angle differential using equation 6 which uses mass as a divisor**).

51. Randal and Predko teach where using a reciprocal of a value as a multiplier can be more efficient than using the value itself as a divisor (**see Randal page 2, column 1 where an 8051 microprocessor running floating point routines required 450 cycles to run a typical multiplication operation and 1070 cycles to run a typical division operation. See also Predko pages 302-304 for pseudo-code representing multiplication and division in a microcontroller where multiplication requires fewer steps than division. It is well known in the art that division in a microprocessor typically requires more computational resources than multiplication. Therefore, in situations where a value is repeatedly used as a divisor, it is more efficient to determine the reciprocal and use it as a multiplier**).

52. It would be obvious to one skilled in the art to calculate the reciprocal value of the mass in Hayakawa, as modified by Crapanzano in claim 24, because reducing computational load when determining a vehicle dynamic which require mass as a variable, such as the side slip angle, is desirable (**see Mori column 1, lines 59-64 where conventional side slip angle estimation methods are problematic due to the increase in the computational load**) and calculating the inverse of the mass and using it as a multiplier in algorithms which call for it to be used repeatedly as a divisor would reduce the computational load (**see Mori figure 4, equation 6. Solving equation 6 using mass would require three division operations whereas solving equation 6 using the reciprocal of mass would require one division operation to find the reciprocal of the mass and 3 multiplication operations. The latter method would be more efficient, as shown by Randal and Predko**).

53. **Regarding claim 30**, Hayakawa, as modified by Crapanzano in claim 13, teaches where the computer-aided differentiating is performed continuously and recursively (**see Hayakawa column 6, lines 26-60**), wherein the computer-aided differentiating is performed one of (a) according to a two-point differentiation and (b) with a state-variable filter (**see the rejection of claim 13 above regarding differentiation**).

54. However, Hayakawa, as modified by Crapanzano in claim 13, does not teach where the calculating includes calculating the mass and a reciprocal value of the mass.

55. Mori teaches where mass is used in the calculation of vehicle parameters, specifically where mass is used as a divisor (**see Mori figures 4 and 9A where a vehicle a vehicle side slip angle is estimated in part by calculating a vehicle side slip angle differential using equation 6 which uses mass as a divisor**).

56. Randal and Predko teach where using a reciprocal of a value as a multiplier can be more efficient than using the value itself as a divisor (**see Randal page 2, column 1 where an 8051 microprocessor running floating point routines required 450 cycles to run a typical multiplication operation and 1070 cycles to run a typical division operation. See also Predko pages 302-304 for pseudo-code representing multiplication and division in a microcontroller where multiplication requires fewer steps than division. It is well known in the art that division in a microprocessor typically requires more computational resources than multiplication. Therefore, in situations where a value is repeatedly used as a divisor, it is more efficient to determine the reciprocal and use it as a multiplier**).

57. It would be obvious to one skilled in the art to calculate the reciprocal value of the mass in Hayakawa because reducing computational load when determining a vehicle dynamic which require mass as a variable, such as the side slip angle, is desirable (**see Mori column 1, lines 59-64 where conventional side slip angle estimation methods are problematic due to the increase in the computational load**) and calculating the inverse of the mass and using it as a multiplier in algorithms which call for it to be used repeatedly as a divisor would reduce the computational load (**see Mori figure 4, equation 6. Solving equation 6 using mass would require three division operations whereas solving equation 6 using the reciprocal of mass would require one division operation to find the reciprocal of the mass and 3 multiplication operations. The latter method would be more efficient, as shown by Randal and Predko**).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this or any earlier communication from the examiner should be directed to Examiner Peter Nolan, whose telephone number is 571-270-7016. The examiner can normally be reached Monday-Friday from 7:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Black, can be reached at 571-272-6956. The fax number for the organization to which this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Peter D Nolan/

Examiner, Art Unit 3661

6/1/2009

/Thomas G. Black/

Supervisory Patent Examiner, Art Unit 3661